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BLOCK SPLITTING ASSEMBLY AND METHOD

Field of the Invention

The invention relates generally to manufacture of masonry block. More specifically, it relates to equipment and processes for the creation of decorative faces on masonry block. Even more specifically, the invention relates to equipment and processes for producing roughened textures and the appearance of weathered or rock-like edges on masonry block.

Background of the Invention

The process of splitting a masonry block to create a rock-like appearance on the exposed face of the block is known. See, for example, Besser, U.S. Patent No. 1,534,353, which discloses the manual splitting of blocks using a hammer and chisel. Automated equipment to split block is well-known, and generally includes a splitting table comprising a supporting table and one or more hydraulically-actuated splitting blades. These machines are useful for the high-speed processing of blocks. They produce a rock-face finish on the blocks. The edges of the faces are generally well-defined, i.e., "sharp".

It is sometimes desirable to produce a concrete product that has edges which appear to be weathered. This has been a desired look for concrete pavingstones for sometime. Recently, it has become desirable to create the weathered look on the decorative face of concrete retaining wall blocks. The common process for producing the weathered look on pavers is to "tumble" the pavers in a rotary drum to knock off their sharp edges. This process can be used with some retaining wall blocks, as well, provided that the blocks do not have any features, such as integral concrete locator flanges, that would be damaged by the tumbling process. Tumbling is not an option with such blocks. The problem with the tumbling process is that it is costly. The process requires the capital investment in a tumbling apparatus, and the upkeep of that

equipment. In addition, the pavers or blocks must be removed from the production line, tumbled, and then reassembled into suitable cubes for transportation. This makes the process labor-intensive.

Another option is to use a hammermill to attack the face of the block with various hammers. This option can slow down production, if it is done "in line", because the process can only move as fast as the hammermill can operate on each block, and the block may need to be manipulated-flipped over and or rotated-to attack all of its edges.

Accordingly, there is a need for equipment and a process that will create the appearance of weathered edges on retaining wall block, in such a manner that it will not slow down the production line, will not add costly equipment to the line, will not be labor-intensive, and will not have high cull rates when processing blocks with integral locator flanges or other similar features.

Summary of the Invention

In accordance with a first aspect of the invention, there is provided a block splitter assembly comprising first and second opposed splitting blade assemblies, each of the first and second splitting blade assemblies comprising respective first and second splitting blades and one or more projections positioned adjacent to each of the first and second blades.

In accordance with a second aspect of the invention, there is provided a block splitter comprising first and second opposed splitting blade assemblies, each of the first and second opposed splitting blade assemblies comprising a plurality of projections.

In accordance with another aspect of the invention, there is provided a masonry block splitter comprising first and second opposed splitting blade assemblies, the first blade assembly comprising a first splitting blade having first and second sides, said first blade assembly comprising a plurality of projections adjacent the first splitting blade first side and a plurality of projections adjacent the first splitting blade second side, the second blade assembly comprising a second splitting blade having first and second sides, the second blade assembly comprising a plurality of projections adjacent

the second splitting blade first side and a plurality of projections adjacent the second splitting blade second side.

In accordance with a further aspect of the invention, there is provided a method of splitting masonry block using a masonry block splitter, comprising first and second opposed splitting blade assemblies, said first blade assembly comprising a first splitting blade having first and second sides, said first blade assembly comprising a plurality of projections adjacent said first splitting blade first side and a plurality of projections adjacent said first splitting blade second side, said second blade assembly comprising a second splitting blade having first and second sides, said second blade assembly comprising a plurality of projections adjacent said second splitting blade first side and a plurality of projections adjacent said second splitting blade second side, said method comprising the step of striking the masonry block with said first and second opposed splitting blade assemblies.

In another aspect of the invention, a gripper assembly is employed to hold the work piece together from the sides during splitting. The gripper assembly could optionally include side knives or projections.

Brief Description of the Drawings

Figure 1 is a partial perspective view of a block splitting machine using the block splitter blade assembly of the invention.

Figure 2A is a top plan view of one portion of a splitting blade assembly in accordance with the invention.

Figure 2B is a top plan view of one portion of a splitting blade assembly also showing protrusion of various diameter positioned in a random manner.

Figure 2C is a top plan view of one portion of a splitting blade assembly in accordance with a further alternative embodiment of the invention comprising protrusions which are random connected and unconnected panels.

Figure 3 is a side elevational view of an alternative embodiment of a protrusion in accordance with the invention.

Figure 4A is a side elevational view of a further alternative embodiment of a protrusion in accordance with the invention.

Figure 4B is a side elevational view of another alternative embodiment of the invention depicting protrusions of varying height.

Figure 5 is a perspective view of a split work piece (forming two masonry blocks), which was split using the splitter blade assembly of the invention.

Figure 6 is a top plan view of a masonry block split using the splitter blade assembly of the invention.

Figure 7 is a front elevational view of the masonry block depicted in Figure 6.

Figure 8 is a partial sectional end view of an alternative embodiment of a top splitter blade assembly.

Figure 9 is a partial sectional end view of an alternative embodiment of a bottom splitter blade assembly.

Figure 10 is a top plan view of a portion of the Figure 9 embodiment of a bottom splitter blade assembly shown in relation to a work piece.

Figure 11 is a top plan view of a gripper assembly according to the present invention, and another alternative embodiment of a bottom splitter blade assembly, shown in relation to a work piece.

Detailed Description of the Preferred Embodiment

Attention is now directed to the figures where like parts are identified with like numerals through several views. In Figure 1, a conventional block splitting machine modified in accordance with invention is depicted, in part, showing in particular the block splitter assembly 10. Generally, block splitting machines may be obtained from Lithibar Co., located in Holland, Michigan. In particular, the Lithibar Co. 6386 was used in practicing the invention. The block splitter assembly generally has opposed first 12 and second 22 splitting blade assemblies. The first splitting blade assembly 12 is positioned at the bottom of the block splitter 10 and as depicted includes

a splitting blade 14 and a number of protrusions positioned on either side and adjacent to the blade.

The invention may be used with any variety of blocks molded or formed through any variety of processes including those blocks and processes disclosed in U.S. Patent No. 5,827,015 issued October 27, 1998, U.S. Patent No. 5,017,049 issued May 21, 1991 and U.S. Patent No. 5,709,062 issued January 20, 1998.

An upper or second splitting blade assembly 22 may also be seen in Figure 1. The second splitting blade assembly 22 also includes a splitting blade 24 and a plurality of projections 26 located on either side of the blade 24. The second splitting blade assembly may be attached to the machine's top plate 30 through a blade holder 28. The position of the work piece 40, (shown in phantom), within the block splitter may be seen in Figure 1, in the ready-to-split position.

As can be seen in Figure 2A, the splitting blade assembly 12 is generally comprised of a number of projections 16 positioned adjacent to blade 14 and on either side of the blade 14. As shown, the projections 16 on the first side of the blade are staggered in relationship to the projections 16' on the second side of the blade. The projections on either side of the blade may also be aligned depending upon the intent of the operator.

As can be seen in Figure 2B, the protrusions 16 may be used without a splitting blade. The protrusions 16 may also be varied in diameter or perimeter, (if not round), and placed randomly on the splitting assembly 12. Any number of ordered or random patterns of protrusions 16 may be created using regular or irregular spacing depending on the effect to be created in the split block. Figure 2C shows a further alternative embodiment of the invention where plates 16" are attached to either, or both, assemblies 12 and 22. As can be seen these plates may be configured in random order and left unconnected across the surface of the assembly 12. The invention has been practiced using steel plates about four inches long welded to the assembly to provide a number of partially connected protrusions 16" about two inches high.

As shown, the projections 16 and 16' may have a rounded shape. However, the shape of the projections may also be pyramidal, cubic, or pointed with

one or more points on the top surface of the projection. Here again the relative position of the work piece 40 is shown in phantom outline.

Generally, the protrusions may have a diameter of about 1/2 to 1 and 1/4 inches and may be attached by welding, screwing or other suitable means. The height of the protrusions may be about 1 and 1/4 inches and varied about 3/4 of an inch shorter or taller depending upon the affect to be created in the block at splitting. Attaching the protrusions by threading or screwing allows easy adjustment of protrusion height.

The relative height of the projection and blade may also be varied depending upon the effect that is to be created in the block split according to the invention. Specifically, as can be seen in Figure 3 the relative height of the blade 14 may be less than the relative height of the projection 16. Alternatively, as can be seen in Figure 4 the relative height of the blade may be greater than the height of the projections 26. Generally, we have found with the first splitting blade assembly that X may range from about 1/8 to about 3/8 of an inch beyond the first blade. With regard to the second splitting blade assembly, X' may range from about 1/16 to 1/8 of an inch beyond the height of the plurality of the projections.

Protrusions 16 such as those depicted in Fig. 2A have been found useful having a diameter of about 1 and 1/4 inches and when used with a blade 14 having a height of about 1/8 of an inch above the blade in the first or lower assembly and 1/8 of an inch below the blade in the second or upper assembly. Overall, the height of the protrusion may vary up or down about 3/8 of an inch relative to the height of the blade.

In operation, the work piece is generally centered in the block splitter according to known practices as seen in Figures 1 and 2. The block splitter is then activated resulting in the first and second opposing splitting blade assemblies converging on, and striking, the work piece 40. In operation, the first and second splitting blade assemblies may travel anywhere from about 1/4 to one inch into the top and bottom surfaces of the work piece. The work piece 40 is then split resulting in an uneven patterning on the split edges 46 and 46' of the resulting blocks, 42 and 44, Figure 5. As depicted, the work piece 40' is split in two. However, it is possible and within the scope of the invention to split the work piece into more than two pieces.

The distance traveled by the protrusions 16 into the work piece may be varied by adjusting the limit switches on the machine and, in turn, varying the hydraulic pressure with which the splitting assembly acts. Generally, the splitting assemblies act on the block with a pressure ranging from about 600 to 1000 psi, and preferably about 750 to 800 psi.

As will be well understood by one of skill in the art, the splitting machine may include opposed hydraulically activated side knife assemblies (not shown) which impinge upon the block with the same timing and in the same manner as the opposed top and bottom assemblies. Projections 16 may also be used to supplement or replace the action of the side knives. For example, side knives similar to the upper splitting blade 24 shown in Figure 8 can be employed.

Closer examination of block 44 after splitting shows the formation of exaggerated points of erosion in the front, split surface 46 of the block 44. With the block 44 depicted, both the first and second blade assemblies 12 and 22 comprised protrusions 16 and 26, respectively. As a result, depressions 48 and 50 were formed in the front, split surface 46 of the block 44, adjacent the upper 52 and lower 54 respective surface of the block 44.

The magnitude of the indentations, 48 and 50, or points of erosion is far greater than that which is caused by conventional splitting blades and may be varied by varying the prominence of the protrusions 16 and 26, (height and size), relative to the height and thickness of the blade. In one embodiment of the invention masonry block may be split with only a row or rows of protrusions 16 and 26 without a blade 14 and 24.

Referring to Figures 8 and 9, alternative embodiments of a top splitting blade assembly 22 and bottom splitting blade assembly 12, respectively, are shown. It has been found that more massive blades 14, 24 having projections 16, 26 thereon create a more desirable block face appearance. Blades 14, 24 include a central cutting edge 21 and surfaces 19, 29 extending outwardly therefrom. Surfaces 19, 29 are at a blunt angle so as to make the top and bottom edges of the block face more rounded and

therefore rock-like, preferably at an angle α between 0° and 30° relative to horizontal, most preferably 23°.

Blades 14, 24 include projections 16, 26 that are adjustable and removable. In this way, the same blade assembly can be used for splitting different block configurations by changing the number, location, spacing and height of the projections. Projections 16, 26 are preferably threaded into corresponding threaded openings 17, 27 for adjustment, although other height adjustment means could be employed. The top surface of projections 16, 26 is jagged, comprising many pyramids in a checkerboard pattern. Projections such as these can be obtained from Fairlane Products Co. It will be understood that a variety of other projection top surface configurations could be employed. The height of the top surface of projections is preferably a distance X' below the top of cutting edge 21, 31, most preferably 0.040 inch below. As discussed above with respect to other embodiments, the projections may extend further below, or some distance above, the top of the blade, within the principles of the invention. The projections shown are 3/4 inch diameter with a 10 thread/inch pitch, and are 1.50 inches long. Diameters between 0.50 and 1.0 inch are believed preferable. The loose block material from the splitting process entering the threads, in combination with the vertical force of the splitting strikes, are considered sufficient to lock them in place.

The preferred top blade assembly 22 is 2.5 inches wide. Projections 26 extend perpendicularly from blade surfaces 29 and therefore strike the working piece at an angle.

The preferred bottom blade assembly 12 is 4.0 inches wide. Projections 16 extend upwardly from shoulders 23 on opposite sides of blade surfaces 19. This configuration breaks away more material and creates a more rounded rock-like top edge (the work piece is typically inverted) of the split blocks. Blade assembly 12 could optionally include projections 16 on blade surfaces 19, as shown in Figure 11.

In operation, the blade assemblies of Figures 8 and 9 are used together and in the same manner described above with respect to cutting depth and hydraulic

pressures. It will be understood that the bottom blade assembly could be used on top, and the top blade assembly could be used on the bottom.

Referring now to Figure 10, a blade assembly according to Figure 9 is depicted positioned for striking a work piece 40. Work piece 40 comprises portions which will result in small 60, medium 62 and large 64 blocks. A projection 16 is preferably placed at each corner of the three blocks 60, 62, 64 to be created, as shown. In this way, more rounded, rock-like corners are formed in the splitting process. This positioning of projections at the block corners can be used in conjunction with mold configurations that pre-form the slab at the corners so as to better achieve this effect. Upper blade assembly of Figure 8 has similarly oriented projections except that they are closer to a centerline of the workpiece, as can be seen from Figure 8.

Referring now to Figure 11, a gripper assembly 70 is shown in conjunction with a work piece 40 and bottom splitting blade assembly 12. Gripper assembly 70 is employed to assist with splitting certain types of larger block units. It is mounted via mounting head 71 on the existing side-knife cylinders of the splitting machine. Rubber shoes 72 are configured to conform to the corresponding outer surface of work piece 40. Each gripper assembly 70 moves in and out laterally, as indicated by arrows, in order to grip work piece 40 from both sides. In the preferred design, assembly 70 is 3.0 inches high and rubber shoes 72 are 50-100 Durometer hardness. The pressure applied by the hydraulic cylinders is the same as that for the upper and lower blades.

One benefit of this gripper assembly is improving the formation of rounded edges of a work piece made by a bottom blade. Product is moved along the manufacturing line by positioning bar 80 in the direction of the arrow shown. During splitting, while the rear portion of work piece 40 is held in place by bar 80, the forward portion is free to move forwardly. Many splitting machines have a splitting action whereby the bottom blade moves to engage the product after the top blade has touched the top of the product. The initial cutting action of the top blade can begin to move the forward portion forwardly before the bottom blade has an opportunity to fully form a rounded edge on the forward block with for example projections 16 and/or blade

surfaces 19. The bottom blade can also lift the work piece, which is undesirable for a number of reasons. By holding work piece 40 together during splitting, these problems are prevented.

Gripper assembly 70 can optionally include projections 16, as shown. Projections 16 are preferably positioned slightly inside the top and bottom edges of the work piece (four projections for each gripper assembly 70) so when they strike the side of the work piece 40, more rounded block corners will be formed. The assembly can also include a side knife contained within its central cavity 73, having a blunt blade such as those described hereinabove, for forming rounded, rock-like side edges of the split blocks. It may be necessary to include an appropriate strength spring behind the side knife in order to get the desired action from the gripper and knife.

The above specification, examples and data provide a complete description of the manufacture and use of the composition of the invention. Since many embodiments of the invention can be made without departing from the spirit and scope of the invention, the invention resides in the claims hereinafter appended.